3-2003

TNH0006-Rations for Horses

The University of Tennessee Agricultural Extension Service

The University of Tennessee
Agricultural Extension Service
TNH-0006

EQUIFACTS

Rations for Horses

Doyle G. Meadows, Professor, Animal Science
Clyde D. Lane, Jr., Professor, Animal Science

Horse owners and other livestock producers have traditionally classified certain feeds as either horse feed, cattle feed or hog feed. Many horse owners believed they had to feed their horses oats and timothy hay and generally paid higher prices for these feeds. Now they have realized that these higher costs were not justified.

Today, horse owners are more aware of alternate feedstuffs. They realize that oats, corn, grain sorghum, timothy hay, alfalfa hay, soybean meal and cottonseed meal are simply sources of basic nutrients. There is nothing magic about any of these feeds; they are simply a way to meet the nutrient requirements of horses.

Feedstuffs divide easily into three categories: forages (pasture and hay), energy feeds (grains) and protein sources (soybean meal and cottonseed meal). All three feedstuffs (forages, grains and protein sources) are important and are used in varying amounts depending on activity, stage of production or age of the horse.

This fact sheet will discuss all three feed categories and then illustrate how these feeds can be used in rations for horses with different stages of growth and production requirements.

Forages

Forages for horses include pastures and hay. Pastures and hays are generally divided into two categories: legumes and grasses. Examples of legumes are alfalfa, clover and lespedeza. Bermuda, timothy, orchard, fescue and bluegrass are examples of grasses.

Pastures and hays can be either grasses or legumes or combinations of the two. The majority of Tennessee pastures are fescue or a fescue and clover mix.

Most fescue pastures in Tennessee are infected with an endophyte fungus that has been implicated as a cause of reproductive problems in brood mares. Pregnant mares should be removed from fungus-infected fescue hays or pastures during the last 90 days of gestation. This will prevent one or more of the following problems: lack of udder development; agalactia (no milk); tough, thickened placentas; abortions; stillbirths; weak foals and rebreeding problems. However, geldings and non-pregnant mares can be fed the fungus-infected fescue with limited problems.

Use either fungus-free fescue varieties or other grasses (orchard, timothy, Bermuda) when establishing horse pastures in Tennessee. If managed and fed properly, most legume or grass hays can be used as forages for horses. However, horse owners should know the nutrient content of these feedstuffs to develop effective and economical feeding programs.

Legumes are higher in protein than grasses and tend to have slightly higher energy values. The energy content of legumes is generally no higher than one megacalorie of digestible energy per pound. The protein content of a typical-quality legume hay is about 15 percent crude protein, with a range of 10 to 20 percent protein on an “as fed” basis. Legumes also contain high levels of calcium and moderate phosphorus levels (Table 1).

Good quality legume hays are excellent horse feeds. Legumes may increase water consumption and urine output, but are not damaging to the normal kidney. Horses should be introduced to legume hays gradually.

Grass hays range in energy content from .6 to .9 megacalories of digestible energy per pound.

Protein content is generally low to moderate and ranges from 6 to 12 percent crude protein. Grass hays vary in nutritional value because they are easily affected by maturity at harvesting, fertilization rates and moisture. Grasses are moderate sources of calcium and phosphorus (Table 2).

Hays that are green, leafy and free from dust and contaminants can provide at least part, if not all, of a horse's daily nutrient requirements. If forages are mature, bleached, weathered, dark and dusty, they may not contain sufficient nutrient content to meet the requirements of horses. Food quality forages may be used as the sole source of feed to meet maintenance requirements for mature horses, provided these animals have access to a vitamin-mineral supplement. Forages are not considered good sources of energy for hard working or highly productive horses. The horses will need to be supplemented, depending on level or work. It's important to remember that the nutrient content of pasture or hays is greatly affected by the stage of maturity at harvest, season of year, soil fertility, climate, variety and length of storage.

Energy Feeds

Energy feeds, as the name indicates, are high in energy content and low in fiber. These include feeds that are primarily cereal grains, such as corn, oats, sorghum and barley. The digestible energy content of these feeds ranges from 1.30 to 1.56 megacalories per pound of digestive energy. Protein content of energy feeds ranges between 9 and 13 percent crude protein. Energy feeds are poor sources of calcium, but moderate sources of phosphorus (Table 3).

Cereal grains are fed to supply energy. These feeds are included in rations of horses having high energy requirements, such as hard-working horses. They should be fed to horses either whole, coarsely processed (crimped, rolled, flaked) or pelleted. Do not feed finely ground feeds to horses. Fine grinding causes respiratory problems due to dust and may result in an impaction in the digestive tract, causing a colic situation.

Processing grains typically increases digestibility. These processing methods include cracking, rolling, crimping, steam flaking, micronizing or extruding. Digestibility of oats and barley can be improved 2 to 5 percent by processing. The largest increase in digestibility can be achieved by processing milo, wheat and rye. Processing these grains can improve digestibility by up to 15 percent. Processing can improve digestibility of corn by 7 to 9 percent.

Pelleted feeds reduce waste, dust and storage space required while increasing digestibility. However, it is extremely important to feed pellets by weight and not volume. Pellets may be more prone to cause colic due to overconsumption and rapid fermentation of carbohydrates in the digestive tract. Recent research indicates that extruding increases digestibility and reduces colic. However, the extrusion process is so expensive that extruded feeds are not utilized by most feed companies.

All common grains may be used for horses; however, nutritive value and physical characteristics must be considered when formulating diets. Oats, because of their high fiber and lower digestible energy content, are the choice grain for horses. The high fiber content of oats makes feeding oats safer compared to other grains.

Corn is an excellent source of energy for horses. It has much lower fiber levels and contains appreciably more energy than oats. It is also the most economical source of energy available to horses. However, because of its high energy-to-fiber ratio, corn must be fed carefully. A volume of corn may weigh twice as much and contain twice as much energy as an equal volume of oats.

Barley is totally acceptable as a source of grain for horses. It has lower fiber and higher energy levels than oats. If barley is to be fed, it should be steam rolled or crimped to loosen a closely adhered outer hull. Rye, although lower in palatability, can be fed to horses if it has not been contaminated by ergot.

Sorghum grains and wheat can be fed to horses; however, these grains should be processed. These small, dense grains contain extremely small amounts of fiber and should be rolled, cracked or steam flaked to aid in digestion. Wheat should be limited to include no more than 20 percent of the grain mixture.

Proteins Feeds

Grains for young, growing horses, lactating mares and other productive horses will need to be fortified with a high-protein supplement to account for additional protein requirements above maintenance. Protein supplements used in horse nutrition come from both plant and animal sources.

Supplemental plant protein sources are mostly oil seed meals such as soybean meal, cottonseed meal and linseed (flaxseed) meal. Although cottonseed meal does contain gossypol, approximately 25 percent of the supplemental protein can be cottonseed meal without affecting performance. In addition, peanut meal, safflower meal and sunflower meal can be used in horse diets but have limited application due to availability and price (Table 4).

Protein feeds of animal origin, such as dried skim milk, fish meal, casein and meat meal, can be used in horse feeds; however cost, availability,

palatability and even rancidity preclude most of these products from being widely used in the United States. Dried skim milk is utilized in many foal feeds made by domestic feed processors.

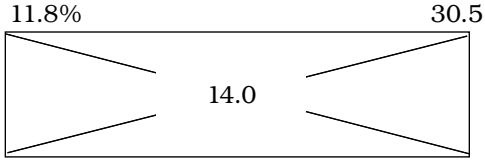
The value of a protein supplement depends not only on its protein content but also on its protein quality (amino acid profile). Soybean meal has been the highest quality protein source in terms of meeting amino acid deficiencies of cereal grains while maintaining an economically feasible ration. Commercially mixed feeds may contain a mixture of protein sources based on least-cost feed formulation.

Actual combination of feedstuffs and the amount of feed for a specific purpose will depend on the following:

1. Availability and cost of the feed
2. Nutrient content of the feed
3. Size of the horse
4. Stage of production (work, growth, lactation, etc.)

At times it is beneficial to know what proportion of feedstuffs to combine to give a mixture with a specific nutrient content, in percent. For example, a horse owner may desire to add soybean meal to oats to get a 14 percent protein mixture. A simple calculation method is to use the "Pearson square method," as shown in the figure below.

Pearson Square Method For Obtaining Proportions



Set in the center of the square is the desired nutrient level (14 percent protein). From Table 3, use the percent crude protein in oats and from Table 4, use the crude protein of soybean meal. Set the percent protein in the feeds on the left side of the square. Diagonally subtract the desired level from the feedstuff level (smaller from greater). The result is the parts of each to be used in the ration and this should be set on the right side of the square. These parts should be added together and each divided by the sum. This value times 100 will be the percent of each feed in the mix. In the example, oats would be 6.7 percent. This would provide a 14 percent mixture of oats and soybean meal.

Oats (percent) = 30.5 ÷ 32.7 x 100 = 93.3% of the ration

Soybean meal (percent) = 2.2 ÷ 32.7 x 100 = 6.7% of the ration

Sample Rations for Horses with Different Nutrient Requirements

The basic nutrients needed by any horse, regardless of the stage of production or level of activity, are energy, protein, minerals and vitamins. These nutrients, in combination with water, provide for the nutritional well being of the horse. A balanced diet is one in which all nutrients are supplied in adequate amounts. However, it is just as important for all nutrients to be supplied in correct amounts relative to each other. A horse ration, the total amount of feed a horse eats in a day, is balanced to meet energy and protein needs of the horse. Minerals and vitamins are then added to complement and balance the ration. A related fact sheet, TNH-0004 **Nutritional Needs of Horses**, is available from county Extension offices.

The amount and quality of the grain or concentrate portion of the horse's ration will be determined by the type, quality and amount of the forage. The following are examples of rations that can be fed to meet nutrient needs of different classes of horses.

Rations for Mature Non-working Horses

The mature, non-working horse on a simple maintenance nutrition program is the easiest horse to feed. A mature, 1100-pound horse in average condition should receive about 18 pounds of total feed daily (16.4 MCal of DE), containing 8 percent crude protein, .21 percent calcium and .15 percent phosphorus.

Nutrient requirements of a mature horse at maintenance can be met by feeding a ration of high quality grass hay or pasture. If the grass is low to average quality, two to four pounds of a basic grain mixture may be necessary.

Daily Ration

Type of Hay Used	Forage (lbs.)	Grain Mixture (lbs.)
Legume	16-18	0
Grass/legume	18-20	0
Grass	13-16	2-4

***Grain Mixture**

Ingredient	Percent
Oats	69.0
Corn	30.0
Limestone	0.5
Plain Salt	0.5
Total	100.0

Rations for Pregnant Broodmares

A pregnant mare does not need additional nutrients above maintenance during her first eights months of pregnancy. Feeding the mare to meet maintenance requirements will meet her nutritional requirements from early- to mid-gestation.

However, during the last three months of pregnancy, the fetus grows rapidly, and the mare's nutrient requirements increase substantially. Approximately 18-22 pounds of feed per day (19-20 MCal of DE) will be required to meet the needs of an 1100-pound broodmare. A broodmare in late gestation requires a ration of 9.5 percent crude protein, 41 percent calcium and .31 percent phosphorus. This can be obtained with the following dietary regimens.

Daily Ration
1100-Pound Broodmare in
Eleventh Month of Pregnancy

Type of Hay Used	Forage (lbs.)	Grain Mixture (lbs.)
Legume	14	5[1]
Grass/Legume	14	7[2]
Grass	14	8[3]

[1, 2] Grain Mixture
(Fed with legume hay or grass/legume mixture)

Ingredient	Percent
Oats	61.5
Corn	30.0
Wheat Bran	5.0
Plain Salt	0.5
Molasses	3.0
Total	100.0

[3] Grain Mixture
(Fed with grass hay)

Ingredient	Percent
Oats	53.5
Corn	27.0
Soybean Meal	10.0
Wheat Bran	5.0
Limestone	1.0
Plain Salt	0.5
Molasses	3.0
Total	100.0

Rations for Lactating Broodmares Nursing Foals

The period of time when a mare is nursing a foal is one of critical nutritional stress. The mare must provide milk for the new foal, maintain her own body needs, recover from foaling and rebreed. Failure to meet nutrient requirements will result in decreased milk production, excessive weight loss and interference with rebreeding. The lactating 1100-pound mare, during the first three months of lactation, requires about 25 pounds of total daily feed (28 MCal of DE) containing approximately 12 percent crude protein, .47 percent calcium and .30 percent phosphorus. This represents about a 40 percent increase in energy and 25 percent increase in protein over the pregnant mare in late gestation (eleventh month).

Requirements can be met with the following examples. The rations are those for an 1100-pound mare in the first three months of lactation.

Daily Ration
1100-lb. mare in
the first three months of lactation

Type of Hay Used	Forage (lbs.)	Grain Mixture (lbs.)
Legume	14	10[1]
Grass/Legume	14	11[2]
Grass	14	12[3]

[1, 2] Grain Mixture
(Fed with legume hay or grass/legume mixture)

Ingredient	Percent
Oats	57.0
Corn	29.0
Soybean Meal	5.0
Wheat Bran	5.0
Molasses	3.0
Dicalcium Phosphate	0.5
Plain Salt	0.5
Total	100.0

[3] Grain Mixture
(Fed with grass hay)

Ingredient	Percent
Oats	51.0
Corn	24.0
Soybean Meal	15.0
Wheat Bran	5.0
Molasses	3.0
Limestone	1.0
Dicalcium Phosphate	0.5
Plain Salt	0.5
Total	100.0

Rations for Nursing Foals

Nursing foals, 2 to 3 months of age, require more nutrients for optimum growth and development than are provided in mare's milk. Therefore, providing additional nutrients is essential for the adequate growth rate of these foals. A creep feeder contains a specially formulated creep feed for a foal without allowing the mare access to the feed. The digestive tract of a foal is capable of limited utilization of forage at this very early age. A free choice legume hay may be offered, although

consumption will be small. The creep feed should be highly digestible, well-balanced and fed free choice. A creep feed should contain about 16 percent crude protein, .70 percent calcium and .40 percent phosphorus. A sample creep ration is presented below:

Creep Mixture

Ingredient	Percent
Oats	51.0
Corn	25.0
Soybean Meal	7.0
Molasses	5.0
Plain Salt	0.5
Limestone	1.0
Dicalcium Phosphate	.5
Total	100.0

Rations for Weanlings

Daily feed intake of weanlings should be about 12 pounds of feed per day (15 MCal of DE). The feed should contain about 13 percent crude protein, with calcium and phosphorus levels at .55 and .30 percent of the diet, respectively. Due to the characteristics of the digestive tract, the forage level is still lower for weanlings than a mature horse. Requirements can be met as follows:

Daily Ration

Type of Hay Used	Forage (lbs.)	Grain Mixture (lbs.)
Legume	4-5	6-7[1]
Grass/Legume	4-5	7-8[2]
Grass	4-5	8-9[3]

Grain Mixture[1,2]
(Fed with legume hay or grass/legume mixture)

Ingredient	Percent
Oats	54.5
Corn	34.0
Soybean Meal	7.0
Molasses	3.0
Plain Salt	0.5
Dicalcium Phosphate	1.0
Total	100.0

Grain Mixture[3]
(Fed with grass hay)

Ingredient	Percent
Oats	50.0
Corn	28.5
Soybean Meal	15.0
Molasses	3.0
Limestone	2.0
Plain Salt	0.5
Dicalcium Phosphate	1.0
Total	100.0

Rations for Yearlings (18 Months Old)

Total Daily feed intake for yearlings should be approximately 16 pounds (20 MCal of DE). The crude protein of the total daily rations is about 11 percent with calcium and phosphorus levels at .35 and .20 percent of the ration, respectively. The following rations can be utilized throughout the year and should meet the nutrient requirements of the yearling.

Daily Ration

Type of Hay Used	Forage (lbs.)	Grain Mixture (lbs.)
Legume	8	7[1]
Grass/Legume	8	8[2]
Grass	8	9[3]

Grain Mixture[1,2]
(Fed with legume hay or grass/legume mixture)

Ingredient	Percent
Oats	57.0
Corn	34.0
Soybean Meal	5.0
Molasses	3.0
Dicalcium Phosphate	0.5
Plain Salt	0.5
Total	100.0

Grain Mixture[3]
(Fed with grass hay)

Ingredient	Percent
Oats	55.0
Corn	30.0
Soybean Meal	10.0
Molasses	3.0
Dicalcium Phosphate	0.5
Limestone	1.0
Plain Salt	0.5
Total	100.0

Rations for Working Horses

Working horses are divided into three categories for the purpose of assigning nutrient requirements. The first category is light work and refers to horses performing English and Western Pleasure, equitation and bridle path hack. Moderate work would include horses used in ranch work, roping, cutting and barrel racing. Horses doing intense work would include those involved in race training and polo.

The primary consideration is to meet the energy need of the mature working horse. It will take approximately 20-30 pounds of feed per day to meet the energy requirement of a horse in race training. The dietary proportions of this horse would include 10-12 pounds of hay and 16-18 pounds of grain mixture per day. Lightly and

moderately worked horses would require about 20-22 and 22-24 pounds of feed, respectively. Performance horse concentrate (grain mixture) and ration are shown below.

Performance Horse Concentrate

Ingredient	Percent
Oats	70.0
Corn	20.0
Wheat Bran	5.0
Molasses	5.0
Total	100.0

Performance Horse Rations

Ingredient	Pounds
Performance Horse Concentrate	13.0
Grass Hay	8.0
Legume Hay	4.0
Beet Pulp	2.0
Vegetable Oil	0.6
Total	100.0

Most horse owners purchase commercially mixed, prepackaged feeds. Tags on these feeds indicate crude protein, fat, fiber, calcium and phosphorus levels. The fiber content is related to the energy content. The lower fiber feeds contain higher energy levels (Table 5) which should be reflected in the feed pricing schedule. Most commercially mixed feeds contain 8 to 10 percent fiber.

Vitamin and Mineral Supplementation

Many horse owners add vitamin and mineral supplements to their existing rations. However, the horse is able to get most of the necessary vitamins from pasture, hay and grain. Vitamin and mineral availability and content from these plant sources are variable and are required in different amounts based on stage of production or activity by the horse. However, millions of dollars are wasted each year due to overfeeding unnecessary nutritional products to horses already consuming an adequate diet.

Summary

Basically all plant feed sources can be fed to horses if two rules are followed. First, the feed must be properly processed; and second, the feed must be fed in certain quantities to meet nutritional requirements. Obviously, these conditions would only hold true for feeds that were free from diseases and insects. To make a diet that is palatable and nutritious, it is mandatory that only high quality feed ingredients be utilized. High quality ingredients will produce a superior, economical ration.

Table 1
Nutrient Content of Selected Legume Hays[1, 2]

Hays	Digest. Energy (Mcal/lb.)	Protein (%)	Ca (%)	P (%)
LEGUMES				
Alfalfa (mid-bloom)	0.94	17.00	1.24	0.22
Alfalfa (full-bloom)	0.89	15.50	1.08	0.22
Lespedeza, common (mid-bloom)	0.88	11.40	1.07	0.17
Lespedeza, kobe (mid-bloom)	0.89	10.00	1.11	0.32
Clover, red	0.89	13.20	1.22	0.22
Clover, ladino	0.89	20.00	1.20	0.30

[1]Nutrient Requirements of Horses, fifth revised edition, 1989.
[2]Sun-cured hay, as fed basis

Table 2
Nutrient Content of Selected Grass Hays[1, 2]

Hays	Digest. Energy (Mcal/lb.)	Protein (%)	Ca (%)	P (%)
GRASSES				
Bermuda, coastal (15-28 days growth)	0.87	10.60	0.35	0.24
Bermuda, coastal (45-56 days growth)	0.79	7.30	0.24	0.17
Timothy (mid-bloom)	0.80	8.60	0.43	0.20
Orchard grass (late-bloom)	0.78	7.60	0.24	0.27
Bluegrass, Kentucky (full-bloom)	0.72	8.20	0.24	0.25
Fescue, Kentucky (full-bloom)	0.86	11.80	0.40	0.29
Prairie, midwest	0.67	5.80	0.32	0.12

[1] Nutrient Requirements of Horses, fifth revised edition, 1989.
[2] Sun-cured hay, as fed basis

Table 3
Nutrient Content of Selected Grains[1, 2]

GRAINS	Digest. Energy (Mcal/lb.)	Protein (%)	Ca (%)	P (%)
Oats	1.30	11.80	0.08	0.34
Corn	1.54	9.19	0.05	0.27
Barley	1.49	11.7	0.05	0.34
Sorghum Grains	1.46	11.5	0.04	0.32
Wheat (hard, red, winter)	1.56	13.0	0.04	0.38

[1]Nutrient Requirements of Horses, fifth revised edition, 1989.
[2]As fed basis

Table 4
Nutrient Content of Selected High Protein Feeds[1, 2]

Protein Sources	Digest. Energy (Mcal/lb.)	Protein (%)	Ca (%)	P (%)
Soybean Meal (44% solvent extracted)	1.43	44.50	0.35	0.63
Cottonseed Meal (41% solvent extracted)	1.25	41.30	0.17	1.11
Linseed Meal-Flax (solvent extracted)	1.25	34.60	0.39	0.80
Yeast, Brewers	1.40	43.40	0.14	1.36
Milk (skimmed)	1.73	33.40	1.28	1.02
Fish meal (Menhaden)	1.33	62.20	5.01	2.87

[1]Nutrient Requirements of Horses, fifth revised edition, 1989.
[2]As fed basis

Table 5
Relationship of Crude Fiber to Expected Digestible Energy in Mixed Concentrate Feeds[1]

Crude Fiber (%)	Digestible Energy (Mcal/lb.)
2.0	1.62
4.0	1.55
6.0	1.45
8.0	1.35
10.0	1.25
12.0	1.15

[1]Calculated values obtained from Nutrient Requirements for Horses, fifth revised edition, 1989.

TNH-0006 3/03 E12-4415-00-021-03

COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS
The University of Tennessee Institute of Agriculture, U.S. Department of Agriculture, and county governments cooperating in furtherance of Acts of May 8 and June 30, 1914.
Agricultural Extension Service Charles L. Norman, Dean